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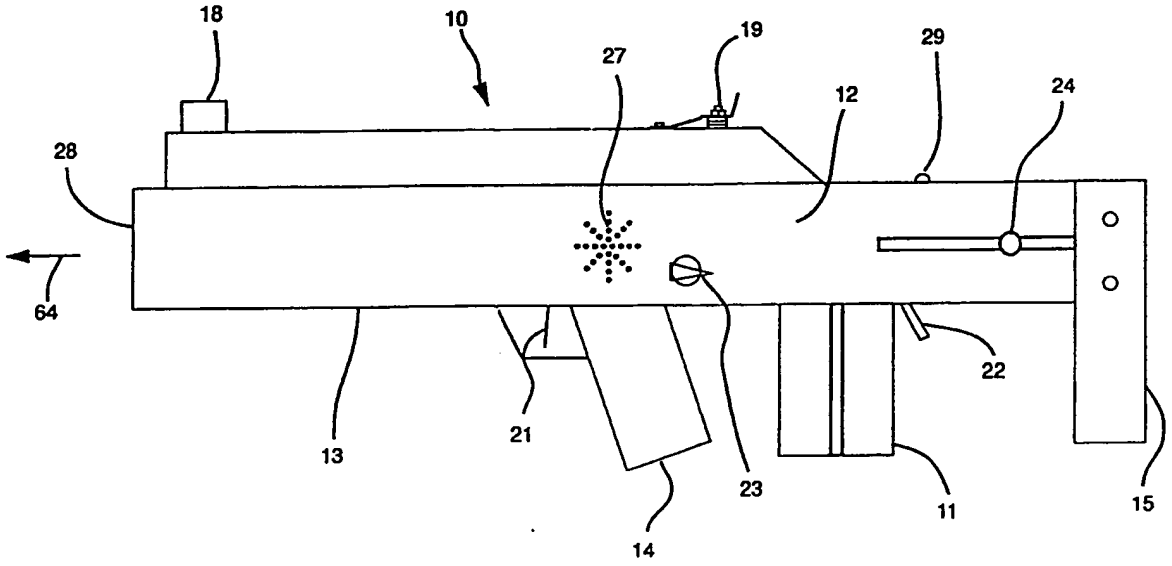
GB 1595189 A EP 0401731 A1 WO 87/04512 A1

(58) Field of search
UK CL (Edition K) F3C CTD CTE
INT CL[5] F41A, F41G
ONLINE WPI

(54) Simulated weapon system

(57) A simulated firearm system includes a gun body (10) and a replaceable magazine (11) which is electronically either charged or discharged; if charged, a specific number of shots are available. Only if a charged magazine is present, a trigger (21) on the gun body causes a detectable beam (64) to be emitted towards a target. An electronic counter records the number of shots fired from the magazine and disables the system when the magazine is "empty".

Figure 1.



GB 2 259 559 A

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

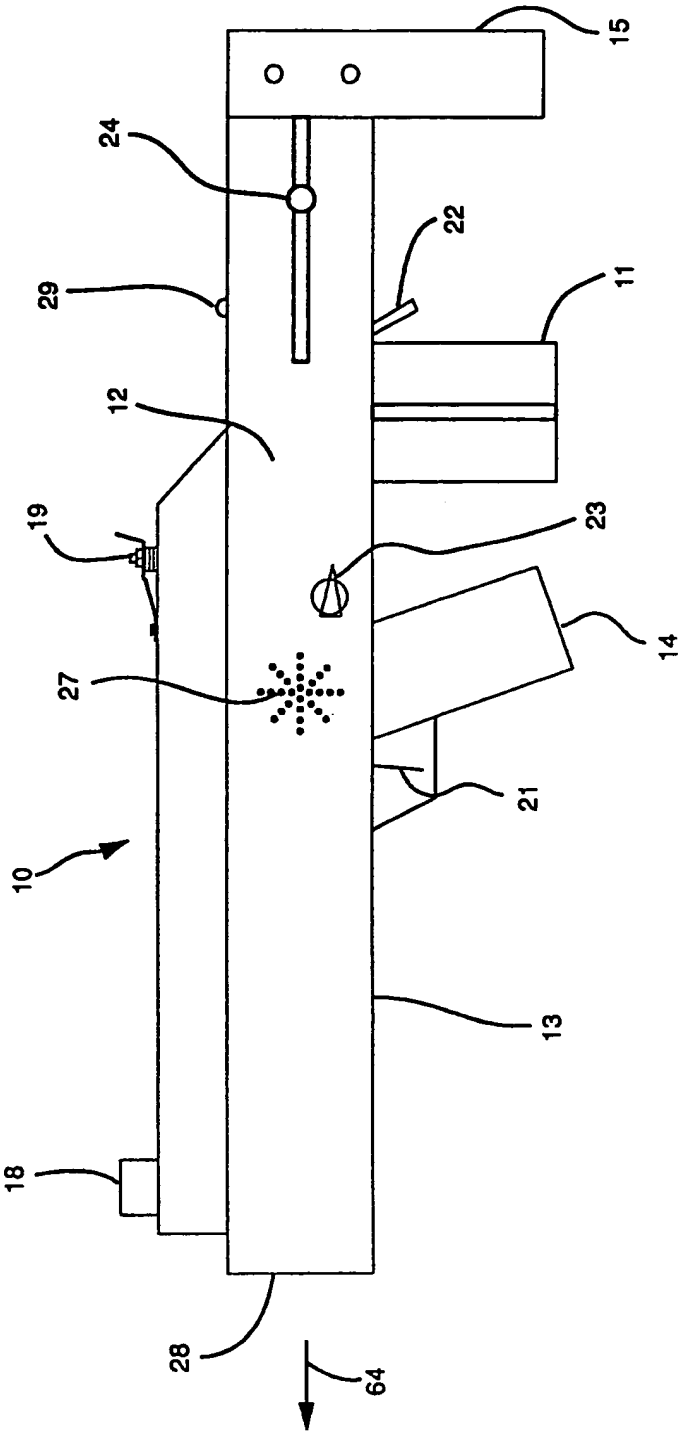


Figure 1.

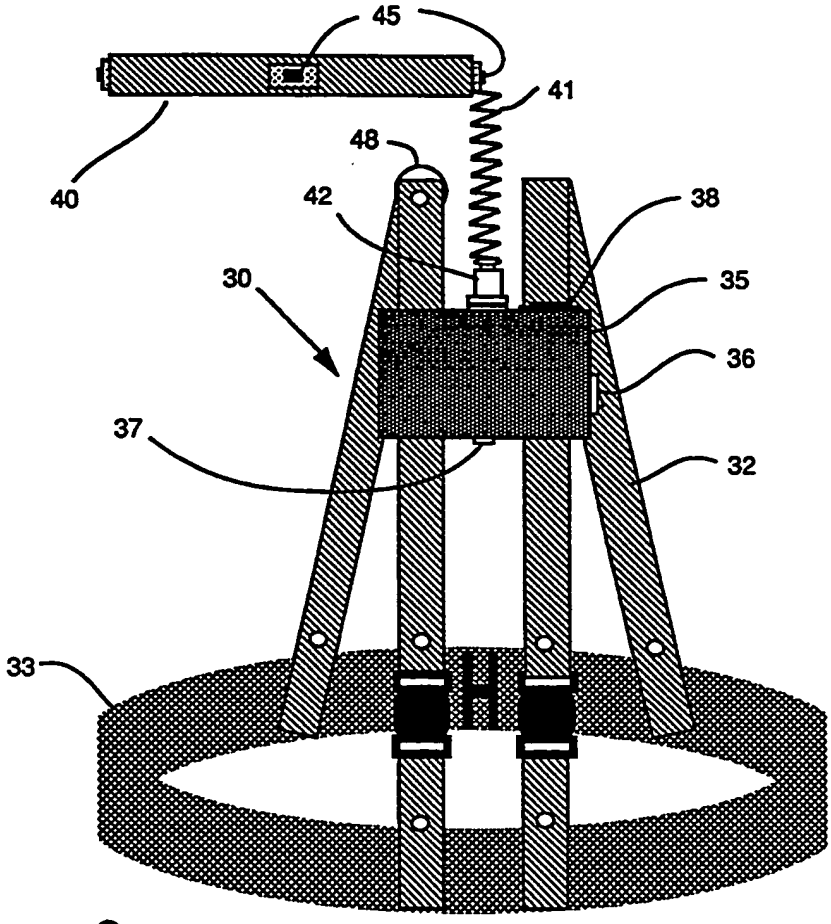


Figure 2.

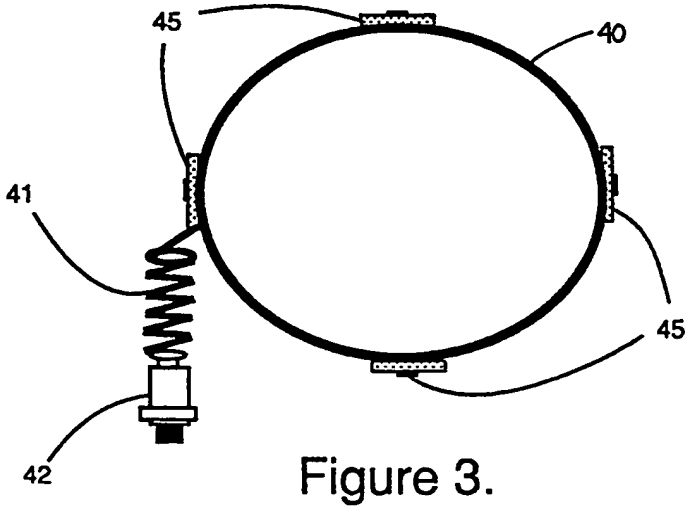


Figure 3.

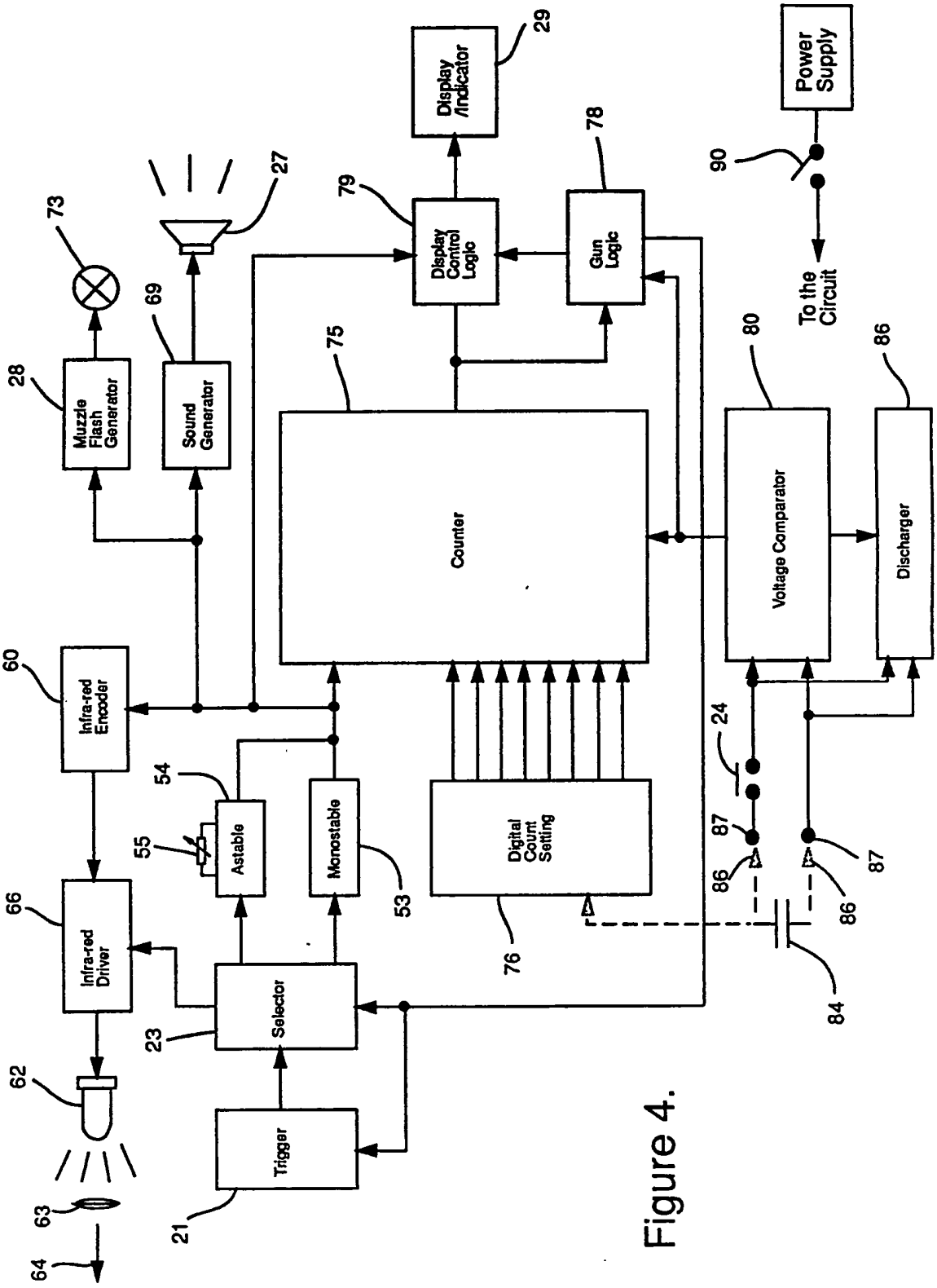

Power Supply
90
To the Circuit
Display /Indicator
29
78
Gun Logic
79
Display Control Logic
27
73
69
28
Muzzle Flash Generator
Sound Generator
75
Counter
80
Voltage Comparator
86
Discharger
60
Infra-red Encoder
54
55
Astable
Monostable
53
Digital Count Setting
24
87
86
66
Infra-red Driver
23
Selector
76
84
62
63
64
Trigger
21

Figure 4.

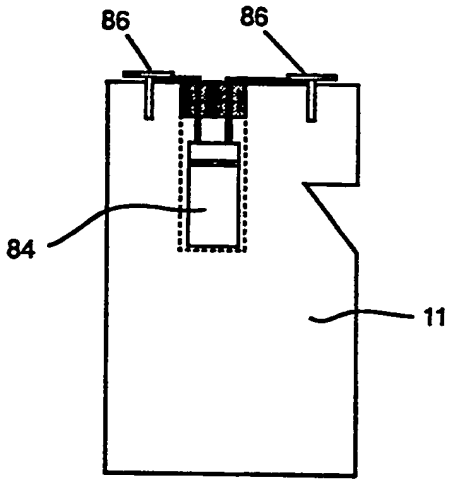


Figure 5.

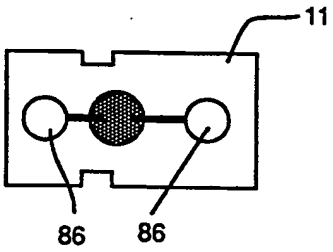


Figure 6.

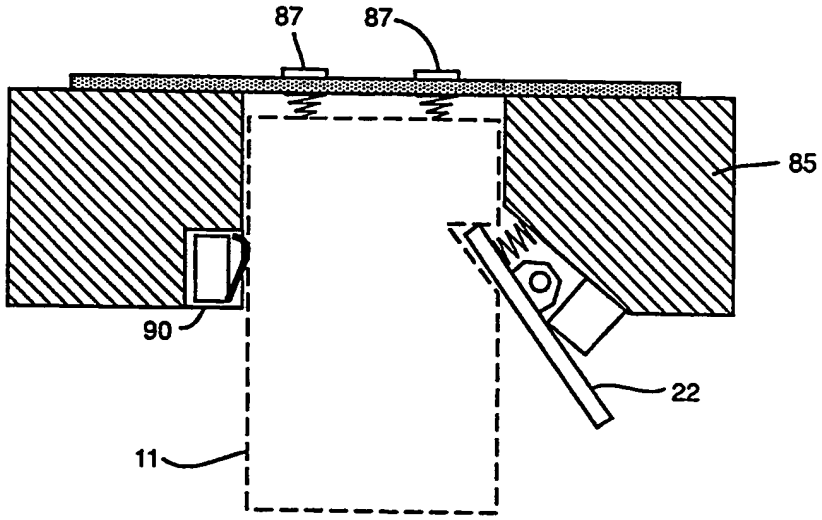


Figure 7.

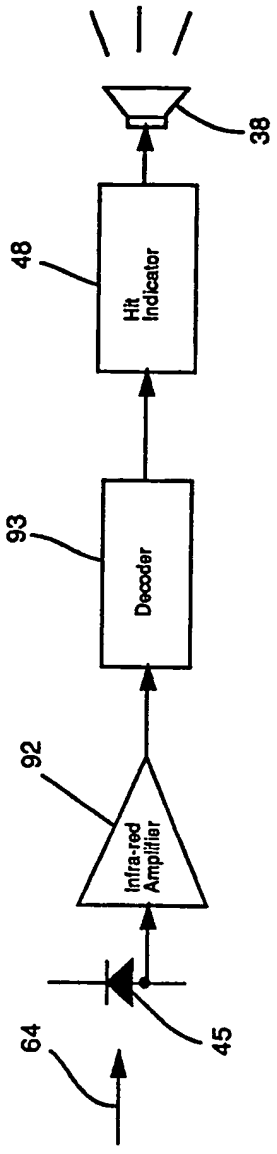


Figure 8.

SIMULATED WEAPON SYSTEMS

This invention relates to simulated weapon systems for the purposes of training and the playing of games.

Currently used military infra-red training systems that simulate infantry combat rely on clip-on laser units that are barrel-mounted on the soldiers' standard issue rifles. These are triggered into the emission of a burst of infra-red light, simulating a bullet, whenever a blank round of ammunition is fired. This "bullet" can then be picked up by sensors located on harnesses worn by opposing soldiers and signals to them that a shot has been received and that they are deemed to be "hit".

The disadvantages of the known apparatus include that it is costly in terms of consumables and dangerous for close quarter combat simulation, by virtue of its use of blank cartridges.

This invention seeks to provide an alternative to using real weapons and blanks by simulating the functionality of the weapon electronically and thus reducing the inherent danger, opening up the simulation to non-military personnel, and reducing operating costs.

The present invention concerns aspects of the simulated firearm system described below. The scope of the invention extends to all novel aspects of the system, whether individually or in combination with other novel features described herein.

In one aspect of the invention, a simulated firearm system comprises separable components representing respectively a gun body and a complementary replaceable magazine mountable thereon. The gun body includes means for discharging a detectable beam towards a target upon actuation of trigger means. The magazine is capable of charged and discharged states. When a magazine in a charged state is mounted on the gun body, thereby assembling the firearm system,

a value is made available to be read by the system which corresponds to a specific number of subsequent discharges of the beam. The assembled system includes means for enabling the discharge means, for counting subsequent discharges until the said specific number is attained, and for thereafter disabling the discharge means.

Thus loading a charged magazine on to the gun body sets a value into the system which corresponds to a specific number of shots, the system counts down at each discharge until the system is "empty" when that number of shots has been discharged.

The represented gun body and magazine should, as far as possible, be of such a weight, shape and size as to simulate a real weapon system. Likewise, all user-operated mechanisms, controls and fittings are desirably similar externally to those on the weapon being simulated. For further verisimilitude, means may be provided for accompanying each beam discharge with an audible report and with a visible muzzle flash.

The detectable beam is normally invisible, and may be ultrasonic or, preferably, infra-red. The extended system of the invention includes a detector responsive to said beam on a mounting adapted to be worn by a simulated combat participant, such as a clip or harness. The beam may be surrounded by a second, wider angle beam, to which the detector may respond by signalling a near miss.

The charged and discharged states of the magazine may suitably be represented by an electric charge or by solid state memory. Since, in practice, magazines are apt to be lost, it is preferable to use a low cost charge state indicator in the magazine, such as a simple electrical capacitor. The means for counting the discharges may be in the gun body, for the same reason. It may be an analogue device, wherein a stored electric charge is diminished at each discharge until a threshold or zero value is reached with the last

discharge, or preferably a digital device, which counts up or down by one unit at each discharge, until a final permitted value is reached, corresponding to an empty weapon.

In a preferred embodiment, a charged magazine is mounted in position on the gun body, whereupon it charges value receiving and storing means in the gun body at once and is itself discharged. Alternatively the magazine retains a value count itself according to the number of discharges of the system. Means are provided for disabling the discharge means upon removal of the magazine.

A preferred simulated firearm system comprises a simulated rifle and an infra-red receiving system. A charged magazine must first be inserted into the weapon and a "cocking lever" actuated in order to fire any shots. In the case of a simulated rifle a selector switch is provided, that in the preferred embodiment, has three positions: safe, semi-automatic and fully automatic, as can be normally found on a modern assault rifle. On the safe setting the weapon is disabled from firing. On the semi-automatic setting the rifle will fire a single shot for every depression of the trigger and on the fully automatic setting the rifle will fire a stream of shots.

When the trigger is pulled and a shot is fired a beam of coded infra-red light is emitted from the muzzle end of the rifle barrel. If this is detected by the sensors worn by another player, then an audible and/or visual indication of the hit is produced by the sensor unit. At the same time as a shot is fired the rifle produces a bright visible muzzle flash out of the barrel of the weapon and produces a loud simulated gun-shot sound.

For each charged magazine that is inserted into the rifle an internal counter is set to a specific count which represents the number of shots that the magazine contains. In the preferred embodiment each magazine can only be used once and must be recharged before it can be used again.

This present invention allows a player to carry around a number of magazines to simulate a real quota of ammunition - with all the inherent limitations, weight and manipulative stress that this imposes. Players of this type of game are now faced with the possibility of running out of ammunition at critical times within a game or firefight and having to change a magazine under these stressful conditions.

The apparatus may be used for playing a game for amusement, or may be used for training purposes.

The invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a side elevation of an example simulated weapon;

Figure 2 is a rear elevation of a harness carrying an infra-red receiving system;

Figure 3 is a top view of a headband portion of the harness of Figure 2;

Figure 4 is a block diagram of the electrical circuits incorporated within the weapon assembly;

Figure 5 is a diagrammatic vertical section showing the major components of an example magazine;

Figure 6 is a top plan view of the magazine of Figure 5;

Figure 7 is a diagrammatic side view of an example magazine housing found within a rifle; and

Figure 8 is a block diagram of a circuit for the detection of the radiation emitted from the weapon.

The simulated assault rifle shown in Figure 1 has a main body 10 and a removable and replaceable magazine 11. The body comprises a stock portion 12 including a notional barrel 13, a pistol grip 14 and an abbreviated butt 15. Foresight 18 and backsight 19 are mounted over the stock. User-operated mechanisms include a trigger 21 located ahead of the pistol grip, a thumb catch 22 for releasing the magazine, a selector switch 23 on the side of the stock for selecting safe, semi-automatic (single shot) or fully automatic modes, and a cocking lever 24 for activating the system after a charged magazine has been loaded. Other fittings include a speaker 27 on the side of the stock, a flash generator 28 at the muzzle end of the barrel, and a display 29 on the stock above the magazine.

Figures 2 and 3 show a harness 30 as worn by a participant. The harness comprises webbing shoulder straps 32 and belt 33. Control box 35 is carried by the straps on the participant's back and includes power switch 36, recharging socket 37, and speaker 38.

A separate headband 40 is connected to control box 35 by a flexible downlink cable 41 terminating in releasable connector plug 42. Four infra-red sensors 45 are set equidistantly around the headband to detect incoming radiation from any side.

One webbing shoulder strap 32 also carries an audible and visible hit indicator 48 driven from the control box 35.

The operation of the simulated firearm system can be better understood by reference to Figure 4. Selector 23 switches between safe, single shot and automatic fire positions. In the safe position the trigger 21 is disabled. In the single shot position monostable oscillator 53 is enabled. Each pull of the trigger then results in a single pulse of about 1/100 of a second. In the automatic fire mode astable oscillator 54 is selected. Each pull of the trigger then results in a stream of pulses with an approximate mark/space ratio of about 9:1. This can be varied via

a potentiometer 55 to simulate different cyclic rates of fire. However, in no case can a pulse be output unless a loaded state signal is input to the selector from gun logic circuit 18.

The output of the oscillators 53 and 54 is fed to an encoder/modulator 60 which triggers the emission of a burst of coded infra-red light by infra-red emitter 62 for each trigger pulse received. This is then focused into a narrow beam 64 by lens 63 and projected along the axis of the barrel of the weapon. It will be appreciated that the code can be used to provide a degree of protection against spurious triggering of the receiver and/or may be used to convey information about the firer and/or the calibre of the weapon. The source of infra-red light 62 can be either an infra-red LED (Light Emitting Diode) or a laser. In the preferred embodiment an LED is driven by an infra-red driver 66 which is in the form of constant current generator whose current is determined by plug-in range determining resistors. These can be of different values for single shot and fully automatic and are switched in by the selector 23. This enables the simulation of the different effective ranges of single shot and fully automatic fire of real weapons.

A near-miss code can also be obtained by adding another infra-red encoder and driver, this time driving another infra-red source or sources at higher power and defocused optically to produce a large cone of infra-red radiation surrounding the central narrow beam of "hit code" 64. Detection of this outer cone only, by an adapted receiver (to be described later) results in a near-miss sound being generated to inform the wearer that they have been narrowly missed by the firer.

The output from the oscillators 53 and 54 also triggers sound generator circuit 69 which produces a simulated gun-shot sound from speaker 27 for each trigger pulse received. The intensity of the report can be varied to simulate the use of a noise moderator or silencer.

The utput from the oscillators 53 and 54 also controls muzzle flash generator 28 which produces an intense flash of visible light 73 out of the end of the barrel of the weapon.

The output pulses from the oscillators 53 and 54 are counted by a counter 75. In the preferred embodiment this is a programmable counter, the count being set by digital setting 76 present on the programming inputs of counter 75 and can be in the range of 1 to 255. This digital input 76 can be either preset (ie by a bank of switches) or made to vary in response to parameters found on individual magazines 11 (as described later).

An output of the counter is connected to gun logic circuitry 78 which records the status of the weapon, ie whether or not the weapon is loaded. In the preferred embodiment this includes a bistable latch whose outputs provide information for display control logic circuit 79 which controls display 29. The display 29 can be in the form of a simple two state loaded/unloaded indicator or may be in the form or a digital counter that displays the number of shots that are loaded or left in the weapon. At switch-on (to be described later) the logic circuit 78 is biased into the unloaded condition and the display 29 will indicate that the weapon is in an empty state. On the receipt of a pulse from magazine voltage comparator circuit 80 (to be described later) the logic circuit 78 changes state and the display 29 indicates that the weapon is loaded. An output of the logic circuit 78 to selector 23 also enables the oscillators 53 and 54, allowing the weapon to function, ie fire shots, until the count set on the counter 75 by the count setting 76 is reached. When this occurs, an output from the counter 75 resets the logic 78 which disables the oscillators 53 and 54 and the weapon as a whole will not fire any more shots, thus effectively emulating the "out of ammunition" condition found in real weapons.

To reload the weapon a charged magazine must then be inserted in place of the discharged one. Details of the magazine are shown in Figures 5, 6 and 7, although most of the related circuitry is located in the gun body and is illustrated in Figure 4.

The magazine circuitry is centred around voltage measuring circuit 80. In its simplest embodiment this can consist of an op-amp voltage comparator. When a magazine 11 is inserted into the weapon and cocking lever 24 is actuated, the voltage stored on magazine capacitor 84 is compared to a reference voltage within the gun body before being discharged by discharge circuit 86 to prevent re-use, effectively emptying the magazine. Depending on this comparison the magazine comparator circuit 80 outputs a pulse which is detected by the counter 75 and the gun logic circuit 78. This resets the counter 75 to its preset value 76, or in some other embodiments to a value controlled by the state of the magazine, and sets the latch within the gun control logic circuit 78 to the loaded state.

The magazine 11 comprises a casing which is designed to simulate a real weapon magazine in which is sealed a large value capacitor 84 (eg 1000μF or above) connected to two terminals 86 on the top of the magazine. The action of inserting the magazine into its housing 85 in the gun body (Figure 7) switches on the weapon by depressing the on/off switch 90. Removal of the magazine in this embodiment turns the weapon off. The magazine is held in the weapon after insertion by thumb catch 22 and terminals 86 are placed in contact with spring connectors 87 of the gun body. To simulate a loaded magazine the capacitor is charged to a preset voltage before insertion into the weapon (ie at the start of a game). The presence or absence of a voltage on the capacitor 84 when inserted into the weapon determines whether or not the magazine is loaded and whether it will load the weapon or not. After interrogation by the gun voltage comparator 80 the magazine is then discharged in a predetermined way by the discharger 85. For the magazine to be used again to load the weapon to its maximum

preset count the magazine capacitor 84 must again be charged as in the first instance. It will be appreciated that in a more advanced embodiment the voltage on the capacitor 84 can be divided up into sectors to provide more detailed information on the number of shots stored and sectors subtracted (ie progressively discharged) for each shot fired until an "empty" threshold is reached.

The magazines 11 may also carry additional information about the number of shots that they represent encoded in some measurable parameter, such as the shape of the magazine or an arrangement of magnets (not shown) around the magazine case which the digital count setting 76 will interpret so as to program the counter 75 accordingly. In this way different magazines (usually of different physical size) can code for different numbers of shots by altering the digital count settings 76 electronically.

The detector circuitry illustrated in Figure 8 is carried by a participant on the harness shown in Figures 2 and 3. The infra-red light 64 from the rifle is received by one or more sensors 45. In the preferred embodiment the sensors are four infra-red photodiodes. The signal received by the photodiodes 45 is then amplified 92 and decoded/demodulated 93 before providing an output to an audible/visible hit indicator 48 and speaker 38. This audible/visible indication can be momentary or latched. If a latched output is used, provision is made for a suitable device to reset the unit either as part of the game or as a referee's accessory (eg a reed switch and an electromagnetic actuator or a reset code).

Provision can also be made to recognise different codes/modulation frequencies. When this is combined with an additional logic circuit and sound circuit a near-miss sound can be generated on receipt of the near-miss code. The logic circuit controls the output of the sound generators, ie if a near-miss code is received together with a hit code then the shot is deemed to be accurate and a hit sound only is generated.

CLAIMS

1. A simulated firearm system comprising separable components, representing respectively a gun body and a complementary replaceable magazine mountable thereon, wherein the magazine is capable of electronically represented charged and discharged states and the gun body has means for discharging a detectable beam towards a target upon actuation of trigger means when a magazine in a charged state is mounted on the gun body.

2. A simulated firearm system according to claim 1 wherein the charged and discharged states of the magazine are represented by an electric charge or by solid state memory.

3. A simulated firearm system according to claim 2 wherein the charged and discharged states of the magazine are represented by the charge condition of an electrical capacitor.

4. A simulated firearm system according to any one of the preceding claims wherein the action of mounting a charged magazine on the gun body enables a limited number of discharges of the said beam.

5. A simulated firearm system according to claim 4 wherein the action of mounting a charged magazine on the gun body makes a value available to be read by the system which corresponds to a specific number of subsequent discharges of the beam and the assembled system includes means for counting subsequent discharges until the said number is attained, and for thereafter disabling the discharge means.

6. A simulated firearm system according to claim 5 wherein the means for counting the discharges is an analogue device, wherein a

stored electric charge is diminished at each discharge until a threshold or zero value is reached, whereupon the discharge means is disabled.

7. A simulated firearm system according to claim 5 wherein the means for counting the discharges is a digital device, which is adapted to count up or down by one unit at each discharge, until a final permitted value is reached, whereupon the discharge means is disabled.

8. A simulated firearm system according to any one of claims 5 to 7 wherein a charged magazine, upon being mounted in position on the gun body, retains a value count itself according to the number of discharges of the system, and means are provided for disabling the discharge means upon removal of the magazine from the gun body.

9. A simulated firearm system according to any one of claims 5 to 7 wherein the means for counting the discharges is in the gun body.

10. A simulated firearm system according to claim 9 wherein a charged magazine, upon being mounted in position on the gun body, charges value receiving and storing means in the gun body at once and is itself discharged.

11. A simulated firearm system according to claim 9 or claim 10 wherein the value made available by mounting a charged magazine on the gun body is encoded in a measurable parameter that is distinct from the representation of the charged or discharged state of the magazine.

12. A simulated firearm system according to any one of the preceding claims wherein a discharged magazine is rechargeable after removal from the gun body.

13. A simulated firearm system according t any one f the preceding claims wherein the gun body is provided with a selector switch adapted to give different rates of fire upon actuation of the trigger means.

14. A simulated firearm system according to any one of the preceding claims wherein the gun body is provided with means to give a visible flash and a loud sound upon discharge of a beam.

15. A simulated firearm system according to any one of the preceding claims wherein the detectable beam is a coded ultrasonic or infra-red beam and the system further includes a detector responsive to said beam on a mounting adapted to be worn by a simulated combat participant.

16. A simulated firearm system according to claim 15 wherein the beam comprises a narrow beam surrounded by a broader beam and the detector is responsive differently to each beam.

17. A simulated firearm system substantially as herein described with reference to and as illustrated in the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number

GB 9115171.2

Relevant Technical fields

(i) UK Cl (Edition K) F3C (CTD AND CTE)

(ii) Int Cl (Edition 5) F41A AND F41G

Search Examiner

KEN LONG

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI

Date of Search

25 NOVEMBER 1992

Documents considered relevant following a search in respect of claims 1 TO 17

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	EP 0401731 A1 (ERNING) See particularly column 2 line 56 to column 3 line 6 and column 3 lines 26-30	1, 4 and 12
X	WO 8704512 A1 (ACCLES AND SHELVOKE) See particularly page 2 lines 20-35	1-4 and 12
X	GB 1595189 (LAPSO) See particularly page 1 lines 11 to 16 and 79 to 90 and page 4 lines 56 to 76	1, 2, 12 and 15

Category	Identity of document and relevant passages	Relevant to claim(s.

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P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

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